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## Occupational well-being and stress among early childhood professionals : the use of an innovative strategy to measure stress reactivity in the workplace

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## Occupational well-being and stress among early childhood professionals: the use of an innovative strategy to measure stress reactivity in the workplace

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### ABSTRACT

The aim of this study was to examine early childhood professionals' (ECPs) work engagement, burnout and stress regulation in integrated special day-care groups. The participants consisted of 89 ECPs from 21 integrated special day-care groups in Helsinki, Finland. ECPs' work-related well-being was assessed using self-report questionnaires that measured work engagement and burnout. Stress regulation was assessed by measuring salivary cortisol and alpha-amylase activity during consecutive working and weekend day with a total five samples per day. The results indicated that ECPs experienced high levels of work engagement, and even though signs of burnout appeared among ECPs, compared to reference values in general population results showed ECPs generally experienced lower levels of stress. On average ECP's stress regulation was regular, and there were no differences in salivary AA/Cortisol or Cortisol/AA ratios between the working day and weekend day. No connections between stress regulation, work engagement and burnout were found. However, we found associations between ECPs' characteristics and work engagement and burnout; younger ECPs showed lower professional self-esteem and ECPs with higher level qualifications (e.g. special teachers) were more likely to report higher levels of work engagement. The main findings drawn from the data are discussed, and suggestions for future research are provided.

### ARTICLE HISTORY

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### KEYWORDS

Stress regulation; work engagement; burnout; early childhood special education

## Introduction

Every occupation includes aspects that either enhance work motivation and engagement or endanger well-being. Work-related stress and burnout, the negative sides of employment, have been studied across many occupations including teaching (e.g., Demerouti, Nachreiner, Bakker, & Schaufeli, 2001), a highly demanding and stressful profession (Hakanen, Bakker, & Schaufeli, 2006; Kokkinos, 2007; Montgomery & Rupp, 2005). Stressors

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for teachers include work overload, poor working conditions and the need to manage pupils' motivational or behavioral problems (see e.g., Bakker, Demerouti, Hakanen, & Xanthopoulou, 2007; Fernet, Guay, Senécal, & Austin, 2012). Similar challenges apply in different groups of teachers, such as teachers in early childhood education and early childhood special education.

The major interest in the present study is in investigating the potential usefulness of combination of multiple methodologies in studying the well-being of early childhood education professionals at work. We are investigating to what extent early childhood professionals (ECPs) in integrated special day-care groups experience work engagement and burnout. In addition, our aim is to examine to what extent it is possible to use salivary cortisol, salivary alpha-amylase and their ratios as indicators of the functioning of ECPs' stress regulation systems. Combined use of these biomarkers is a novel approach in endocrinological research. Moreover, combining physiological data with participants' self-experienced work-related well-being gives us a multidimensional perspective of the state of ECE professionals' well-being, hence adding significantly to the literature. In addition, the context of our study, the ECP work environment, is of great importance; the unique stressors experienced in this workplace coupled with the significance of the work undertaken by ECPs mean that enhancing understanding of ECP workplace well-being has an impact not just on the workers themselves, but also on children, the future citizens of the world.

### *Workplace stress and well-being in early childhood services*

In Finland, the early childhood service context is unique because many services combine both early childhood education and early childhood special education creating diverse job demands and challenges. Children's behavior can be exceptionally challenging and, combined with lack of resources, ECPs<sup>1</sup> often feel exhausted resulting in challenges to their health and well-being (Bakker, Demerouti, & Verbeke, 2004; Demerouti et al., 2001; Hakanen, 2009). However, there are multiple positive characteristics of working with children that serve to keep ECPs engaged and motivated, and encourage them to remain in the profession. Our previous study has demonstrated that ECPs perceive their job resources to be adequate: for example social support from colleagues and the supervisor was experienced as positive (Nislin et al., 2015). This, in turn, leads to improved work motivation and work engagement (Bakker & Demerouti, 2006; Demerouti et al., 2001).

Work engagement, 'a positive, fulfilling, work-related state of mind characterized by vigor, dedication and absorption'<sup>2</sup> (Schaufeli, Salanova, Gonzalez-Roma, & Bakker, 2002), is relatively stable and permanent over time (Schaufeli, Bakker, & Salanova, 2006). A work-engaged employee sees his/her work as meaningful and is better able to face adversity and negative setbacks at work (Bakker & Leiter, 2010; Hakanen, 2009; Hakanen, Perhoniemi, & Toppinen-Tanner, 2008). Work engagement has also been found to be positively linked to employees' well-being in other life domains (Schaufeli & Bakker, 2004). Altogether, work engagement is enjoyment drawn from work (Bakker & Leiter, 2010; Bakker, Schaufeli, Leiter, & Taris, 2008; Hakanen, 2009), and may serve to balance stress and possibly reduce burnout (Hakanen et al., 2006). ECE professionals who are motivated and healthy perform better at work. Hence engaged and motivated workers are better able to exploit their own resources and are more committed to work (Hakanen, 2009).

This has a positive impact on the entire working community as it enhances a positive work atmosphere and effectiveness (Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2009).

In contrast, limited resources, and correspondingly unreasonably high demands, may generate difficulties in adapting to stressful encounters by restricting the use of helpful strategies. This can lead to maladaptive coping processes, thereby increasing the risk of burnout and health problems (Hakanen, 2009). The development of stress and exhaustion start when an employee continually feels stretched to the limit without support or time for recovery. The accumulation of demands leads to the depletion of energy resources, which finally leads to severe health problems (Hakanen, 2009; Schaufeli, Bakker, & van Rhenen, 2009) and extended periods of sick leave (Bakker et al., 2004). In stressful situations the employee seeks to use coping strategies aimed at resolving the cause of the conflict, and usually such efforts lead to a successful resolution (Hakanen, 2009). Serious burnout is preceded by prolonged coping problems evidenced in maladaptive and powerless behaviors in response to challenges. Maslach and her colleagues (Maslach, Jackson, & Leiter, 1996; Maslach, Schaufeli, & Leiter, 2001) define burnout as a three-dimensional syndrome characterized by exhaustion, decreased professional self-efficacy and cynicism<sup>3</sup>. We anticipate that the ECPs' workplace has both elements that may enhance work engagement and those that may threaten well-being. Hence, this context is particularly challenging and thus an ideal environment for studies on extreme levels of workplace stress and simultaneously positive emotions arising from ECE work.

### *Physiological measures of workplace stress and well-being*

Work-related well-being is fundamentally important economically, socially and individually. Recently, growing number of studies have been conducted that combine both physiological and psychological levels of well-being. However, there is limited application of this approach in the field of early childhood education and the existing literature upon which such studies could be based is highly fragmented (Hall-Kenyon, Bullough, MacKay, & Marshall, 2014). Moreover, physiological measures have not been used in these studies; rather surveys, interviews, and observations are the primary methods of data collection. Hence, in order to obtain a multidimensional picture of ECPs working life, there is a need for research that investigates both physiological and psychological aspects of the work-related well-being and stress.

Some studies have shown a close relationship between the psychological well-being of white and blue-collar workers and their stress regulation systems; a relationship that is responsive to work conditions (see Chandola, Heraclides, & Kumari, 2010; Danhof-Pont, van Veen, & Zitman, 2011). However there is a lack of consensus regarding the connections between physiological and psychological measures with few using biomarkers to examine positive aspects such as work engagement. Instead, research has focused on work stress.

### *Cortisol and alpha-amylase as biomarkers of stress*

Much of the research has addressing physiological responses to work-related stressors has measured stress hormones in saliva. Free salivary cortisol measurements were introduced in psychosomatic research in the 1980s as these are an easy and non-invasive way to obtain an objective measure of the activity of the Hypothalamic–pituitary–adrenal (HPA)

axis (Hellhammer, Wüst, & Kudielka, 2009; Kirschbaum & Hellhammer, 1989). More recently, the activity and/or output of the salivary alpha-amylase (sAA) has been proposed as a new indirect marker of the autonomous nervous system activation produced by stressful situations (Nater & Rohleder, 2009; Rohleder & Nater, 2009).

The stress regulation system is complex and, when triggered, results in a double hormonal and neural response through the sympathetic adrenomedullar system (SAM) and the HPA axis. At a very basic level SAM activation prepares the body's stress response (fight or flight) and this is accompanied by the release of adrenaline and noradrenaline from the adrenal medulla into general circulation (Chrousos, 2009). The activation of SAM can be assessed by sAA (Nater & Rohleder, 2009; Rohleder & Nater, 2009). sAA levels increase during a stressful event, and are highly connected with the changes in emotional states (Takai et al., 2004).

In parallel, the response of the HPA axis causes an elevation in blood cortisol hormone levels (Chrousos, 2009) in order to increase blood sugar concentration and thereby assuring sufficient energy supply for the body's stress response. Although both responses collaborate to enable the body to cope with a stressor (Sapolsky, 2000), they operate at different times. The main product of HPA activation is stress hormone cortisol, the secretion of which follows activation of the SAM system (Kirschbaum & Hellhammer, 1989). While the SAM response is quick and oriented toward supporting the initial fight/flight response to this stressor (as measured by sAA levels), the cortisol response is characterized by a delayed start and is oriented toward the suppression of the initial stress response and, especially, the balancing of the allostatic load caused by this response (Chrousos, 2009; Sapolsky, 2000).

Studies examining both of these biomarkers in the workplace tend to be focused on a pathological perspective (i.e. extreme work stress) and generally concern the manner in which work stress changes cortisol levels. In this respect, high levels of work stress have been linked to an increased cortisol awakening response (Fekedulegn et al., 2012), flatter levels of cortisol along the day (Liao, Brunner, & Kumari, 2013), higher reactivity to specific stressors (Wirtz, Ehler, Kottwitz, La Marca, & Semmer, 2013).

Given the established link between occupational well-being and physiological measures of stress, one might expect the literature to reflect a strong link between these physiological measures and the extreme case of work-place stress (burnout). This is not, however, the case. In some studies, a functional hypo-response<sup>4</sup> or low basal levels of the HPA axis have been associated with burnout although other studies demonstrate either the contrary, or the absence of a relationship (Danhof-Pont et al., 2011). In a recent study, emotional exhaustion and global burnout scores showed the strongest and most consistently negative associations with cortisol at the time of waking (+30 minutes), in the afternoon, and in the evening. In contrast, professional inefficacy was associated only with lower bedtime cortisol levels (Marchand, Juster, Durand, & Lupien, 2014). Finally, the latter authors reported no associations for cynicism, and no moderator role for gender in the secondary analyses. Langelaan, Bakker, Schaufeli, van Rhenen, and van Doornen (2006) found an association between salivary cortisol and dehydroepiandrosterone-sulfate (DHEA) ratios, and work engagement and burnout. However, the differences between burned-out and work-engaged employees were only marginal. It is clear from these studies that the current understanding of the physiological underpinnings

of burnout is still in its infancy and that more work is needed to further develop knowledge in this area.

Unfortunately, research employing sAA measurements is not useful in clarifying the situation; no differences in sAA activity have been observed under different levels of burnout (Díaz-Rodríguez et al., 2011; Juster et al., 2011). To date the studies on this issue are scarce, though a reduction in sAA activity levels has been reported after a stress management intervention with lower or middle management employees (Limm et al., 2011). Moreover, no studies have examined possible changes in the cortisol and sAA ratios associated with burnout. Consequently, no potential biomarkers for burnout exist to date (Danhof-Pont et al., 2011). Thus there is a need for further research on salivary cortisol and sAA ratios and their links to burnout to help unpack the physiological complexity of this extreme case of workplace stress. In particular, the relations between stress regulation measured by both salivary cortisol and sAA and work engagement are highly interesting topics, hence they have not been widely established in the literature.

### *Ratios of sAA and cortisol are a unique method to analyze stress*

The technical possibility of analyzing salivary cortisol and sAA activity and/or output in the same saliva sample in a non-invasive and relatively inexpensive manner originated from a study of the psychological and physiological significance of salivary cortisol/sAA and sAA/salivary cortisol ratios (Ali & Pruessner, 2012; Hidalgo, Almela, Villada, & Salvador, 2014). The combination of both of these measurements in a unique ratio value (e.g., cortisol/sAA or, alternatively, sAA/cortisol) is thought to be a better marker of chronic stress or mood disorders (such as anxiety, depression or burnout) than cortisol or sAA levels alone (Ali & Pruessner, 2012; Hidalgo et al., 2014). For example, Ali and Pruessner (2012) have shown, in an experimental sample of adolescents suffering a history of early learning adversities, that the reactivity of the sAA/cortisol ratio to the Trier Social Stress Test is a better marker of chronic stress and depression than the cortisol/sAA ratio or the cortisol or sAA activity levels alone. This result is coherent with the asymmetry in the norepinephrine to cortisol levels observed between Post Traumatic Stress Disorder (PTSD) patients compared with other psychiatric groups (Mason, Giller, Kosten, & Harkness, 1988). Nevertheless, the exact physiological and psychological meaning of the coordinated or asymmetrical actions represented by these ratios is still under debate due to the scarce number of data (Ali & Pruessner, 2012). To the best of our knowledge, no data have so far been published on the possible changes in these ratios in relation to work engagement and burnout.

### *Research questions and hypotheses*

In this study, we first analyze ECPs' work engagement and possible problems with coping in order to enhance our understanding of the nature of the challenges involved in their simultaneously demanding and rewarding work. Secondly, we concentrate on the physiological aspects of their workplace well-being.

Q1: To what extent do ECPs in integrated special day care groups experience burnout and work engagement, and do the different professions differ in this?

H1: There are multiple challenges in ECSE work. We hypothesize that ECPs with lower qualifications and training experience their work as more demanding and will show higher levels of



burnout. More qualified ECPs are better prepared to encounter challenges, which is evident in higher levels of work engagement.

Q2: How does ECPs' stress regulation in terms of salivary cortisol over alpha-amylase (COA) and salivary alpha-amylase over cortisol (AOC) ratios vary during working day and weekend day?

H2: We hypothesize that ECPs' stress regulation system is more active during the working day than weekends. This will be seen in higher ratio values in AOC and lower COA values during working day.

Q3: How is ECPs' perceived work engagement and burnout associated with their stress regulation?

H3: The combination of the biomarkers (COA, ACO) which measure both the functioning of the SAM and HPA systems will show connections to experienced work engagement and burnout. We anticipate higher levels of work engagement might be associated with more balanced ratio values (see e.g. Ali & Pruessner, 2012). In turn, higher levels of burnout may be connected with higher ratio values.

## Method

### Context

In Finland, every child has a right to early childhood education services delivered through ECE centers guided by national guidelines. These guidelines serve as a basis for the design of local curricula; nevertheless municipalities are fully responsible for the interpretation and implementation of the services (Suhonen & Nislin, 2012). Approximately 82% of children with special educational needs attend regular day-care centres. Children with high support needs also attend these centers but are placed in an integrated special group within the center. These integrated special groups usually consist of up to seven children without special needs and five children with special needs. Additional staff (compared to the requirements for regular groups) are required to work in these integrated special groups: the minimum requirement is two special education teachers, one nursery nurse and one assistant. Special education teachers have received an additional degree in early childhood special education. This environment represents a unique EC environment, combining the challenges of usual EC services with those related to special needs.

### Participants and procedure

The data for the study were collected between 2012 and 2013, and is part of a longitudinal research program on children's learning and development in early childhood special education settings operating from the University of Helsinki. The present study population consists of 89 ECPs from 21 integrated special day-care groups in Helsinki, Finland, selected from the longitudinal study. Participation in the study was voluntary, and the participants were made aware of their freedom to withdraw from the study at any time. The study has been approved by the Ethics Committee on Human Studies of the University of Helsinki.

The groups in which the ECPs worked consisted of seven support children (children who were developing normally) and five children with SEN. The children with SEN included those with specific language impairments, challenges in self-regulation and severe disabilities. Groups of 12 children (7 + 5) were supported by 4 staff working together as a team. ECP teams were multi-professional consisting of two special education teachers, one nurse, and one assistant. The ECPs were between 21 and 63 years old ( $M = 44.5$ ;  $SD = 10.5$ ).



The background characteristics of the educators are presented in [Table 1](#). Where there was missing information, values were not imputed.

We collected the ECPs' experiences of work engagement and burnout using self-report surveys, and measured their stress levels with salivary cortisol and AA measurements. The ECPs also filled a background questionnaire to collect basic demographic information, such as educational level, work experience, illnesses, or use of medication.

### Work engagement

The Utrecht Work Engagement Scale (UWES; Hakanen, [2009b](#)) was used to measure ECPs' experiences of the motivating and encouraging aspects of work. This is a widely used instrument in occupational well-being literature with 17 questions addressing a three-dimensional structure of work engagement:

- vigor: e.g. 'When I get up in the morning, I feel like going to work'; (6 items in total)
- dedication: e.g. 'I am enthusiastic about my work'; (5 items in total)
- absorption: e.g. 'I feel happy when I am working intensely' (6 items in total)

The answers were rated on a seven-point scale (0 = never, 6 = every day, 7 = I cannot say). The psychometric properties of the UWES questionnaire proved to be high (Seppälä et al., [2009](#)).

### Burnout

The Maslach Burnout Inventory (MBI) was used to assess burnout. A standardized survey, the MBI, is widely used in occupational well-being research (Maslach et al., [2001](#)). The psychometric properties and structural validity of the inventory have been widely confirmed (Schutte, Toppinen, Kalimo, & Schaufeli, [2000](#)). The inventory is based on the three factorial structures of burnout: emotional exhaustion, depersonalization, and reduced professional self-esteem (Maslach et al., [2001](#)). Emotional exhaustion (5 items) is a core element of burnout and represents the extent to which an employee feels overextended and can

**Table 1.** ECPs' background characteristics.

Age	Assistant <i>n</i>	Nurse <i>n</i>	Teacher <i>n</i>
<30	4	3	2
30–50 years	4	8	25
>50	7	8	9
Total	15	19	36
<i>Educational background</i>			
Secondary school	8	7	0
Secondary education	7	11	3
Bachelor's degree	0	0	31
Total	15	28	34
<i>Period of employment</i>			
0–4 years	7	3	2
5–10 years	3	3	4
Over 10 years	5	12	31
Total	15	18	37

no longer cope. Depersonalization (5 items) reflects negative attitudes and responses toward another person (children, colleagues, parents, etc.). Reduced professional accomplishment (6 items) assesses an employee's feelings of reduced competence and achievements at work (Maslach et al., 1996). Answers were rated on a seven-point scale, ranging from '0 = never' to '6 = daily'.

### *Free salivary cortisol and alpha-amylase activity*

To reveal the diurnal patterns of free salivary cortisol and AA activity, five saliva samples per day were collected on a working day and a weekend day:

- immediately after waking;
- 30 minutes after waking;
- one hour after waking
- in the afternoon between 14:00 and 15:00
- just before going to bed.

The participants were instructed to not drink, eat, or smoke for 15 minutes before collecting the samples. They were also asked to report medication intake and chronic illness on the saliva collection days; we were able to confirm that there was no use of prolonged medication that would distort the results. We were also able to check timing of collection since the participants wrote down the time of each measurement point on their samples.

All salivary cortisol samples were obtained by mouthing on two-inch cotton wads (Salivette Collection Kit, Salivette, Nürmbrecht). The wet wads were placed in Salivette tubes and stored immediately in a refrigerator before being delivered to the laboratory of the Finnish Institute of Occupational Health (FIOH) in Helsinki, where the saliva was separated from the cotton wad by centrifugation (1000 g for 5 min) and stored at a  $-20^{\circ}\text{C}$  until analysis using a chemiluminescence immunoassay LIA kit (LIA, IBL, Hamburg, Germany) with the measurement range of 0.43–110 nmol/l. Salivary  $\alpha$ -Amylase activity was analyzed with Salivary  $\alpha$ -Amylase Assay kit (Salimetrics). The kit is specifically designed and validated for the kinetic measurement of salivary  $\alpha$ -amylase activity. The method utilizes a chromagenic substrate linked with maltotriose. The enzymatic action of  $\alpha$ -amylase on this substrate yields 2-chloro-p-nitrophenol which can be measured at 405 nm. The amount of  $\alpha$ -amylase reactivity present in the sample is directly proportional to the increase in absorbance at 405 nm. The Coefficient of Variation % of Intra-assay is 2.5–7.2% and inter-assay is 3.6–5.8% depending on concentration. The laboratory at FIOH was also responsible for verification of the validity of the measurements.

### *Statistical analysis*

We used SPSS IBM 20 to perform the statistical analyses. The free cortisol and AA activity measurements resulted in some extreme values. Although these values were within the normal range, they could have distorted the interpretation of the analysis. Therefore, to avoid the violation of test assumptions caused by the skewness, we inspected all cortisol and alpha-amylase values for outliers, which were converted equally into the most extreme values (ranging between  $-4$  SD and  $+4$  SD from the mean values) measured, as recommended in (Nicolson, 2008).

We computed the missing values ( $N = 4$ ) with the EM algorithm in cases where there were only two values missing in the series. We gained the descriptive statistics for salivary cortisol and alpha-amylase measures to demonstrate the diurnal patterns of both variables. Further, to detect the variation in biomarker variables between two days, we conducted pairwise comparisons ( $t$ -test). To obtain the total diurnal response of the salivary cortisol and sAA activity, we calculated the area under the curve with respect to the ground (AUC<sub>g</sub>) using the same trapezoid formula described in Pruessner, Kirschbaum, Meinlschmid, and Hellhammer (2003). Then, to demonstrate the variation in sAA activity levels after corrections for variations in cortisol, the AUC of the sAA activity was divided by the AUC of the free cortisol to derive an overall ratio variable (AOC) (Ali & Pruessner, 2012). We also calculated the same ratio variable for cortisol (COA) by dividing the AUC of the salivary cortisol by the AUC of the sAA activity; this variable demonstrated the variations in cortisol levels when the variation in sAA activity was corrected. We used the student's  $t$ -test for paired data to compare the ratio values of salivary cortisol over sAA activity (COA) and sAA activity over cortisol (AOC) on the working day and the weekend day.

We ranked the ECPs' scores for burnout and work engagement according to the cut-off scores in the MBI and the UWES manuals to illustrate the deviation among participants. Additionally, we use ECPs' age, period of employment and profession as grouping variables in comparisons between ECPs' characteristics and experienced work engagement and burnout. If the test assumptions for the parametric test (ANOVA) could not be verified due to the small sample size, we used the Mann-Whitney U-test or the Kruskal-Wallis test for comparison. In addition, we conducted correlation analyses to test the correlations between salivary cortisol and sAA activity and work engagement and burnout.

## Results

To answer study question 1, we first examined the descriptive statistics relating to participants' experienced work engagement and burnout, as presented in Table 2. Second, we compared the variances of burnout and work engagement in different occupational groups and according to the ECPs' background characteristics, such as age, illnesses, and length of employment. To answer study question 2, we first obtained the descriptives relating the free salivary cortisol and alpha-amylase over working and weekend days and the ratio (COA, AOC) estimates. Further, the results of the connections between occupational well-being, stress regulation, and job performance are presented at the end of the results section.

### *Burnout and work engagement*

Serious burnout symptoms ( $M = 4.9$ ,  $SD = 0.74$ ) were very rare (1.4%); rather, 35% of the ECPs showed moderate exhaustion. The occupational groups (teachers, nurses and assistants) did not differ in terms of perceived burnout ( $\chi^2(3) = 2.62$ ,  $p > .05$ ). Nor was there differences between ECPs with different educational backgrounds ( $\chi^2(3) = 2.5$ ,  $p < .05$ ) or educational qualifications ( $U = 326.5$ ,  $p > .05$ ). Likewise, no correlations between burnout and ECP characteristics were observed. However, the sub-dimension, decreased professional self-esteem, was negatively correlated with ECPs' age ( $r = -.28$ ,  $p < .05$ ) and period of employment ( $r = -.40$ ,  $p < .01$ ). This indicated that the younger the ECP or the

**Table 2.** ECPs' experienced burnout and work engagement according to profession, age and period of employment.

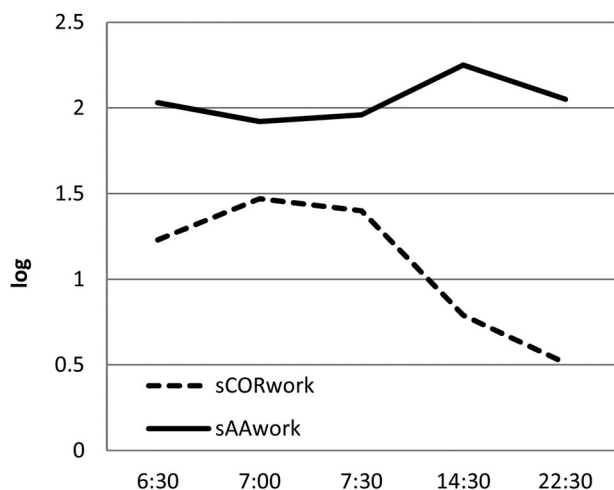
Burnout		N	Mean	SD	Min	Max	None	Moderate	Serious	
Profession							n	n	n	
	Assistant	15	1.51	1.09	0.05	3.46	8	7	0	
	Nurse	19	1.24	0.75	0	2.8	11	8	0	
	Special teacher	37	1.12	0.96	0.08	5.07	26	10	1	
	Total	71	1.25	0.94	0	5.07	45	25	1	
Age										
	<30	7	1.27	0.37	0.83	1.68	4	3	0	
	30–50	39	1.3	1.05	0	5.07	22	16	1	
	>50	24	1.11	0.9	0.05	3.37	19	5	0	
	Total	70	1.23	0.94	0	5.07	45	24	1	
Period of employment										
	<5	12	1.72	1.33	0.05	5.07	6	5	1	
	5–10	7	1.09	0.79	0	2.08	4	3	0	
	>10	51	1.16	0.83	0.08	3.37	34	17	0	
	Total	70	1.25	0.94	0	5.07	44	25	1	
Work engagement		N	Mean	SD	Min	Max	High	Moderate	Modest	Low
Profession							n	n	n	n
	Assistant	15	4.47	0.87	2.88	5.6	4	2	5	4
	nurse	19	4.89	0.81	3.06	5.82	10	4	2	3
	Special teacher	37	5.02	0.59	3.24	5.88	16	14	4	2
	Total	71	4.87	0.74	2.88	5.88	30	20	11	9
Age										
	<30	7	4.4	1.02	2.88	5.38	2	2	1	2
	30–50	39	4.97	0.62	3.24	5.88	18	11	6	3
	>50	24	4.82	0.76	3.06	5.82	9	7	4	4
	Total	70	4.86	0.74	2.88	5.88	29	20	1	9
Period of employment										
	<5	12	4.55	1.05	2.88	5.6	5	2	1	4
	5–10	7	4.81	0.43	4.12	5.35	2	2	2	0
	>10	51	4.95	0.68	3.06	5.88	22	16	8	5
	Total	70	4.87	0.74	2.88	5.88	29	20	11	9

shorter the working period in early special education, the more the ECP experienced reduced professional self-esteem.

Most ECPs experienced notably high levels of work engagement. A total of 43.5% of the participants reported high levels of work engagement; only 13.5% reported low levels, and 25.9% reported modest levels. Work engagement correlated negatively with burnout ( $r = -34, p < .01$ ); those who were highly engaged were unlikely to burnout. Work engagement ( $r = .26, p < .05$ ), and especially vigor ( $r = .31, p < .05$ ), were positively correlated with qualifications; ECPs with higher level qualifications were more likely to report high levels of work engagement and vigor. The Mann–Whitney test confirmed that the difference was statistically significant between assistants (more lowly qualified) and special teachers (the highest level of qualification), both in terms of vigor ( $U = 1.43, p < .05$ ) and work engagement ( $U = 1.46, p < .05$ ). The ECPs' age correlated with dedication ( $r = .24, p < .05$ ); the older the ECP, the higher the level of dedication.

### Free salivary cortisol and alpha-amylase activity

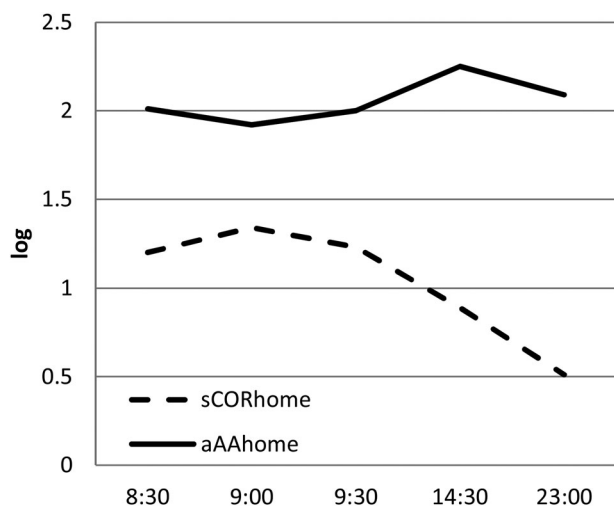
The diurnal patterns of free salivary cortisol and sAA activity during the working day and the subsequent weekend day are presented in Figures 1 and 2 and descriptive statistics are shown in Table 3. Salivary cortisol levels followed a typical pattern on both days (Wilcox, Granger, Szanton, & Clark, 2014), that is, the levels were higher in the morning



**Figure 1.** Diurnal patterns of salivary cortisol and alpha-amylase during working day.

peaking in half an hour after awakening, and then decreased slightly toward the evening with the lowest values measured just before going to bed. The diurnal patterns were symmetrical on both days, but there were statistically significant differences in the second, ( $t(75)=5.63, p<.00$ ), third ( $t(77)=6.34, p<.00$ ), and fourth ( $t(77)=-3.5, p<=.001$ ) measurement points between the working day and the weekend day; on the working day, the average morning peak was sharper, and the values were higher during the day than on the weekend day. Although the working day values declined to lower levels toward the end of the day compared to the weekend day, this difference was not statistically significant.

The sAA levels were also quite stable on both days, but there was a slight decline during the first 30 minutes of waking hours on both days. After that, the values increased steadily until the afternoon, after which the values declined again toward the evening. The



**Figure 2.** Diurnal patterns of salivary cortisol and alpha-amylase during weekend day.

patterns were quite similar on both days, and the values differed significantly only at the second ( $t(75) = -3.061$ ,  $p = .003$ ) and fifth ( $t(75) = -2.163$ ,  $p = .034$ ) measurement points. This wave form in the profile is typical for the diurnal secretion of sAA (Wilcox et al., 2014).

Further, our aim was to detect if the ratio values of cortisol and alpha-amylase vary between working day and weekend day, but no differences were found. This indicates that even though there is statistically significant differences in cortisol and alpha-amylase values alone between the working and weekend day, stress regulation determined with ratio values show stability across the two day. The values of salivary cortisol and alpha-amylase AUC values and COA and AOC ratio values are presented in Table 3. As a final study question, we were interested if there are associations between the work engagement, burnout and stress regulation variables. We conducted the correlational analyses, but no connections between the ratio values (COA, AOC) and self-reported work engagement nor burnout were found.

## Discussion and conclusion

Our results demonstrated that ECPs were engaged in their work. However, signs of moderate burnout symptoms were detected, indicating that they face stressors that may, if they become chronic, endanger their occupational well-being. ECPs' diurnal stress regulation followed, on average, a typical pattern and there were only slightly higher levels of cortisol during working days. The ratios of cortisol and alpha-amylase (COA, AOC) were stable across the two days. Against our expectations, there were no demonstrable connections between physiological and psychological measures of workplace stress and well-being.

The main positive result in our study was that participants were dedicated and motivated by their work with children. It is likely that ECPs who enjoy their work are more able to handle work-related challenges and other negative aspects in a constructive way. Compared to other sectors (information technology, health care, school authorities) ECPs scored higher in work engagement, and only doctors and high-level managers showed more work dedication (Hakanen, 2009b). Work engagement of individual workers is also a positive result for the entire working community as work engagement tends to be contagious (Perhoniemi & Hakanen, 2013). Engaged employees strengthen teamwork and improve the well-being of the whole team (Hakanen, 2009; Hakanen et al., 2006).

Serious burnout symptoms rarely occurred among the participants, and only 35% reported moderate burnout. Should these symptoms become chronic, and no support

**Table 3.** Salivary cortisol and alpha-amylase AUC and ratio values during working and weekend day.

	N	Min	Max	Mean	SD
AUCcortisolDay1	77	4.53	17.89	11.75	2.11
AUCcortisolDay2	79	4.87	18.9	12	2.54
AUCalphaD1	78	10.75	36.31	29.72	4.78
AUCalphaDay2	79	7.87	36.74	30.09	5
AOCDay1	77	1.11	6.25	2.64	0.8
AOCDay2	79	1.1	5.26	2.61	0.72
COADay1	77	0.16	0.9	0.41	0.13
COADay2	79	0.19	0.91	0.41	0.13

is available to mediate stress, this may lead to serious health problems and poorer work quality.

We compared the levels of burnout with those in other occupation groups (from Kalimo, Hakanen, & Toppinen-Tanner, 2006) and found The ECPs in our study of special education demonstrated on average lower levels of burnout symptoms than did teachers in general education settings (elementary school) and other occupational groups such as lawyers and white- and blue- collar workers. Overall our ECPs had average burnout scores that were lower compared to the overall Finnish population. In this respect, our results demonstrate that ECPs in integrated special day-care groups are highly engaged and satisfied with their work.

As for the second aim of our study, we found no significant relations between the work engagement and burnout, and stress regulation. We found only minor variation in cortisol and alpha-amylase levels (e.g. higher cortisol levels in three measurement points) during working and weekend day, but the ratio values did not differed across the two days, indicating stable stress regulation. Significant variation between the days could have been an indicator of instability in stress regulation system (e.g. Ali & Pruessner, 2012). Perhaps our study participants were healthy, motivated, and were not suffering from any serious depression or burnout; therefore, the connections were not evident. There is only one study to our knowledge that has investigated the relations between the stress regulation and work engagement and our results are in line with the results reported by Langelaan et al. (2006) who also did not find strong associations. It may be that the connections between the physiological and psychological work-related stress variables require more extreme emotional states (anxiety, depression) in order to be reflected in changes in stress hormones. It is possible that positive work-related emotions (e.g. work engagement) are not easily detected on the physiological level.

However, we did find connections between the ECPs' characteristics (e.g., age and competence) and work engagement and burnout. Interestingly, ECPs' age was related to reduced professional self-efficacy; younger educators and those who had worked in the field of early special education for shorter periods were more likely to have lower professional self-esteem. Higher levels of work engagement were specific to older ECPs. It may be that younger, recently graduated ECPs experience a tension between the demands of working life and the preparation for that work provided in their training and academic education. These challenges may cause feelings of inadequacy and disappointment. Younger ECPs are also more likely to think about changing their profession during their first years in the field (Onnismaa, Tahkokallio, Lipponen, & Reunamo, 2013) and this may be because they struggle to establish a secure professional identity and occupational self-esteem. This is an important challenge for teacher education; it should be considered how to improve education to better respond to the demands of the field of early special education. More dialogue between the field and academics is needed, and it should be based on the idea of sharing skills and knowledge. If the atmosphere is open and encouraging, young ECPs with fresh thoughts and ideas about work could come together with experienced ECPs to create a new, even better culture of pedagogical work.

There were limitations in this study. First, we used a cross-sectional study design that did not allow further conclusions about the developmental nature of work engagement and burnout. In addition, due to the small sample size, the generalization of the results should be done with caution. A previous study (Bakker & Bal, 2010) has shown that



there is a possible intra-individual variability in the level of work engagement experienced. This should be considered in further studies. Likewise, we did not investigate the details of the job demands and resources that may have had an impact on the experience of work engagement or burnout, nor did we inquire about the participants' personal lives (e.g., divorce or serious illness of the relative) that may have also had an impact on coping at work. Well-being at work is influenced by a multiplicity of factors related to employees' private lives. Therefore, the direct effect on well-being caused by work is not that obvious; instead, it is composed by the interplay between employees' personal lives and work.

Regardless of the limitations, this study offers important insights into ECPs' work in integrated special day-care groups. The current research is supported by earlier studies suggesting that work in the field of early childhood education is simultaneously demanding and rewarding. Although the current study agrees with the existing literature, our findings suggest that ECPs' work engagement and well-being appear to be higher than suggested by earlier studies conducted in educational settings (Hakanen et al., 2006; Hall-Kenyon et al., 2014). This does not however imply that occupational well-being can be maintained without a focus on appropriate and continuous improvements.

## Notes

1. From this point those who work in early childhood education and/or early childhood special education will be referred to as early childhood professionals (ECPs).
2. Vigor refers to the experience of energy, an employee's desire to make an effort to work and to persevere. Dedication ensues when an employee finds his/her own work meaningful, is excited and inspired by it, and feels proud of his/her own work. Absorption reflects concentration on one's work, a perception that time goes by quickly, and it is hard to end tasks early (Schaufeli et al., 2002).
3. Exhaustion is considered as emotional fatigue: feelings of being emotionally overextended and exhausted by one's work. Reduced professional inefficacy reflects an employee's feelings of incompetence and lack of achievement at work. Cynicism (or depersonalization) at work presents as joylessness and a loss of work meaningfulness. An employee may regard his/her work half-heartedly, and attitudes toward other colleagues may be negative or hostile. Cynicism implies that other people are treated as objects as opposed to real individuals.
4. A pathologically low level of stress response.

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## References

- Ali, N., & Pruessner, J. C. (2012). The salivary alpha amylase over cortisol ratio as a marker to assess dysregulations of the stress systems. *Physiology & Behavior*, 106, 65–72.
- Bakker, A. B., & Bal, M. P. (2010). Weekly work engagement and performance: A study among starting teachers. *Journal of Occupational and Organizational Psychology*, 83(1), 189–206.
- Bakker, A. B., & Demerouti, E. (2006). The job demands-resources model: State of the art. *Journal of Managerial Psychology*, 22(3), 309–328.
- Bakker, A. B., Demerouti, E., Hakanen, J. J., & Xanthopoulou, D. (2007). Job resources boost work engagement, particularly when job demands are high. *Journal of Educational Psychology*, 99(2), 274–284.
- Bakker, A. B., Demerouti, E., & Schaufeli, W. (2003). The socially induced burnout model. In S. P. Shohov (Ed.), *Advances in psychology research*, (Vol. 25, s. 13–30). New York, NY: Nova Science.
- Bakker, A. B., Demerouti, E., & Verbeke, W. (2004). Using the job demands-resources model to predict burnout and performance. *Human Resource Management*, 43(1), 83–104.
- Bakker, A. B., & Leiter, M. P. (2010). *Work engagement. The handbook of essential theory and practice* (pp. 5–20). New York, NY: Psychology Press.
- Bakker, A. B., Schaufeli, W. B., Leiter, M. P., & Taris, T. W. (2008). Work engagement: An emerging concept in occupational health psychology. *Work & Stress*, 22(3), 187–200.
- Chandola, T., Heraclides, A., & Kumari, M. (2010). Psychophysiological biomarkers of workplace stressors. *Neuroscience & Biobehavioral Reviews*, 35(1), 51–57. doi:10.1016/j.neubiorev.2009.11.005
- Chrousos, G. P. (2009). Stress and disorders of the stress system. *National Review of Endocrinology*, 5, 374–381.
- Danhof-Pont, M. B., van Veen, T., & Zitman, F. G. (2011). Biomarkers in burnout: A systematic review. *Journal of Psychosomatic Research*, 70(6), 505–524.
- Demerouti, E., Nachreiner, F., Bakker, A. B., & Schaufeli, W. B. (2001). The job demands-resources model of burnout. *Journal of Applied Psychology*, 86(3), 499–512.
- Díaz-Rodríguez, L., Arroyo-Morales, M., Cantarero-Villanueva, I., Fernández-Lao, C., Polley, M., & Fernández-de-las-Peñas, C. (2011). The application of Reiki in nurses diagnosed with burnout syndrome has beneficial effects on concentration of salivary IgA and blood pressure. *Revista Latino-Americana Enfermagem*, 19(5), 1132–1138.

- Fekedulegn, D., Burchfiel, C. M., Violanti, J. M., Hartley, T. A., Charles, L. E., Andrew, M. E., & Miller, D. B. (2012). Associations of long-term shift work with waking salivary cortisol concentration and patterns among police officers. *Industrial Health*, 50(6), 476–486.
- Fernet, C., Guay, F., Senécal, C., & Austin, S. (2012). Predicting intraindividual changes in teacher burnout: The role of perceived school environment and motivational factors. *Teaching and Teacher Education*, 28, 514–525.
- Hakanen J. (2009). *Työn imua, tuottavuutta ja kukoistavia työpaikkoja? Kohti laadukasta työelämää* [Work engagement, productivity, and flourishing workplaces? Towards high-quality working life]. Helsinki: Report of the Finnish Institute of Occupational Health.
- Hakanen, J. J. (2009b). *Työn imun arviointimenetelmä – työn imu-menetelmän (Utrecht Work Engagement Scale) käyttäminen, validointi ja viitetiedot Suomessa* [Assessing work engagement with the Finnish Version of UWES: The use, validation and norm scores]. Helsinki: Työterveyslaitos. Retrieved from [http://www.wilmarschaufeli.nl/publications/Schaufeli/Test%20Manuals/Test\\_manual\\_UWES\\_Finnish.pdf](http://www.wilmarschaufeli.nl/publications/Schaufeli/Test%20Manuals/Test_manual_UWES_Finnish.pdf)
- Hakanen, J. J., Bakker, A. B., & Schaufeli, W. B. (2006). Burnout and work engagement among teachers. *Journal of School Psychology*, 43, 495–513.
- Hakanen, J. J., Perhoniemi, R., & Toppinen-Tanner, S. (2008). Positive gain spirals at work: From job resources to work engagement, personal initiative and work-unit innovativeness. *Journal of Vocational Behavior*, 73, 78–91.
- Hall-Kenyon, K. M., Bullough, R. V., MacKay, K. L., & Marshall, E. E. (2014). Preschool teacher well-being: A review of the literature. *Early Childhood Education Journal*, 42(3), 153–162.
- Hellhammer, D. H., Wüst, S., & Kudielka, B. M. (2009). Salivary cortisol as a biomarker in stress research. *Psychoneuroendocrinology*, 34(2), 163–171.
- Hidalgo, V., Almela, M., Villada, C., & Salvador, A. (2014). Acute stress impairs recall after interference in older people, but not in young people. *Hormones & Behavior*, 65(3), 264–272.
- Juster, R. P., Sindi, S., Marin, M. F., Perna, A., Hashemi, A., Pruessner, J. C., & Lupien, S. J. (2011). A clinical allostatic load index is associated with burnout symptoms and hypocortisolemic profiles in healthy workers. *Psychoneuroendocrinology*, 36(6), 797–805.
- Kalimo, R., Hakanen, J., & Toppinen-Tanner, S. (2006). *Työuupumuksen arvionti MBI-GS-menetelmällä* [Assessing burnout with MBI-SG]. Helsinki: Työterveyslaitos.
- Kirschbaum, C., & Hellhammer, D. H. (1989). Salivary cortisol in psychobiological research: An overview. *Neuropsychobiology*, 22, 150–69.
- Kokkinos, C. M. (2007). Job stressors, personality and burnout in primary school teachers. *British Journal of Educational Psychology*, 77, 229–243.
- Langelaan, S., Bakker, A. B., Schaufeli, W. B., van Rhenen, W., & van Doornen, L. J. (2006). Do burned-out and work-engaged employees differ in the functioning of the hypothalamic-pituitary-adrenal axis? *Scandinavian Journal of Work, Environment & Health*, 32(5), 339–348.
- Liao, J., Brunner, E. J., & Kumari, M. (2013). *Is there an association between work stress and diurnal cortisol patterns?* Findings from the Whitehall II study.
- Limm, H., Gündel, H., Heinmüller, M., Marten-Mittag, B., Nater, U. M., Siegrist, J., & Angerer, P. (2011). Stress management interventions in the workplace improve stress reactivity: A randomised controlled trial. *Occupational and Environmental Medicine*, 68(2), 126–133.
- Marchand, A., Juster, R. P., Durand, P., & Lupien, S. J. (2014). Burnout symptom sub-types and cortisol profiles: What's burning most? *Psychoneuroendocrinology*, 40, 27–36. doi:10.1016/j.psyneuen.2013.10.011
- Maslach, C., Jackson, S. E., & Leiter, M. P. (1996). *MBI: The Maslach Burnout Inventory: Manual*. Palo Alto, CA: Consulting Psychologists Press.
- Maslach, C., Schaufeli, W. B., & Leiter, M. P. (2001). Job burnout. *Annual Review of Psychology*, 52, 397–422.
- Mason, J. W., Giller, E. L., Kosten, T. R., & Harkness, L. (1988). Elevation of urinary norepinephrine/cortisol ratio in posttraumatic stress disorder. *The Journal of Nervous and Mental Disease*, 176(8), 498–502.
- Montgomery, C., & Rupp, A. A. (2005). A meta-analysis for exploring the diverse causes and effects of stress in teachers. *Canadian Journal of Education*, 28(3), 458–486.

- Nater, U. M., & Rohleder, N. (2009). Salivary alpha-amylase as a non-invasive biomarker for the sympathetic nervous system: Current state of research. *Psychoneuroendocrinology*, 34(4), 486–496. doi:10.1016/j.psyneuen.2009.01.014
- Nicolson, N. A. (2008). Measurement of cortisol. In L. Leuken & L. Gallo (Eds.), *Handbook of physiological research methods in health psychology* (pp. 37–74). Thousand Oaks, CA: Sage.
- Nislin, M., Sajaniemi, N., Suhonen, E., Sims, M., Hotulainen, R., Hyttinen, S., & Hirvonen, A. (2015). Work demands and resources, stress regulation and quality of pedagogical work among professionals in Finnish early childhood education settings. *Journal of Early Childhood Education Research*, 4(1), 42–66.
- Onnismaa, E. L., Tahkokallio, L., Lipponen, L., & Reunamo, J. (2013). *The impact of educational background on the early attrition and job commitment among kindergarten teachers*. Presentation at the EECERA Conference, Tallinn, Estonia.
- Perhoniemi, R., & Hakanen, J. (2013). Työn imun ja ystävällisyyden siirtymisen vaikutus työpareilla [Contagion of work engagement and kindness among co-workers]. *Psykologia*, 48(02), 88–101.
- Pruessner, J. C., Kirschbaum, C., Meinlschmid, G., & Hellhammer, D. H. (2003). Two formulas for the computation of the area under the curve represent measures of total hormone concentration versus time-dependent change. *Psychoneuroendocrinology*, 28(7), 916–931.
- Rohleder, N., & Nater, U. M. (2009). Determinants of salivary alpha-amylase in humans and methodological considerations. *Psychoneuroendocrinology*, 34(4), 469–485. doi:10.1016/j.psyneuen.2008.12.004
- Sapolsky, R. M. (2000). Stress hormones: Good and bad. *Neurobiology of Disease*, 7(5), 540–542.
- Schaufeli, W. B., & Bakker, A. B. (2004). Job demands, job resources, and their relationship with burnout and engagement: A multi-sample study. *Journal of Organizational Behavior*, 25, 293–315.
- Schaufeli, W.B., Bakker, A.B., & Salanova, M. (2006). The measurement of work engagement with a short questionnaire: A cross-national study. *Educational and Psychological Measurement*, 66, 701–716.
- Schaufeli, W. B., Bakker, A. B., & van Rhenen, W. (2009). How changes in job demands and resources predict burnout, work engagement, and sickness absenteeism. *Journal of Organizational Behavior*, 30, 893–917.
- Schaufeli, W. B., Salanova, M., Gonzalez-Roma, V., & Bakker, A. B. (2002). The measurement of engagement and burnout: A two sample confirmatory factor analytic approach. *Journal of Happiness Studies*, 3, 71–92.
- Schutte, N., Toppinen, S., Kalimo, R., & Schaufeli, W. (2000). The factorial validity of the Maslach Burnout Inventory-General Survey (MBI-GS) across occupational groups and nations. *Journal of Occupational and Organizational Psychology*, 73(1), 53–66.
- Seppälä, P., Mauno, S., Feldt, T., Hakanen, J., Kinnunen, U., Tolvanen, A., & Schaufeli, W. (2009). The construct validity of the Utrecht work engagement scale: Multisample and longitudinal evidence. *Journal of Happiness Studies*, 10(4), 459–481.
- Suhonen, E., & Nislin, M. (2012). Inclusive models in early childhood intervention in Finland. In R. S. Haustätter (Ed.), *Inkluderende spesialundervisning* (pp. 159–168). Bergen: Fagbokforlaget.
- Takai, N., Yamaguchi, M., Aragaki, T., Eto, K., Uchihashi, K., & Nishikawa, Y. (2004). Effect of psychological stress on the salivary cortisol and amylase levels in healthy young adults. *Archives of Oral Biology*, 49(12), 963–968.
- Wilcox, R. R., Granger, D. A., Szanton, S., & Clark, F. (2014). Diurnal patterns and associations among salivary cortisol, DHEA and alpha-amylase in older adults. *Physiology and Behavior*, 129, 11–16.
- Wirtz, P. H., Ehler, U., Kottwitz, M. U., La Marca, R., & Semmer, N. K. (2013). Occupational role stress is associated with higher cortisol reactivity to acute stress. *Journal of Occupational Health Psychology*, 18(2), 121–131. doi:10.1037/a0031802
- Xanthopoulou, D., Bakker, A. B., Demerouti, E., & Schaufeli, W. B. (2009). Work engagement and financial returns: A diary study on the role of job and personal resources. *Journal of Occupational and Organizational Psychology*, 82, 183–200.